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SHORTER ARTICLES AND DISCUSSION

THE ONTOGENY OF A GENUS

In the systematic work of to-day there is noticeable a tendency toward undue magnification of the importance of the smallest units, the species, subspecies, varieties or whatever they are called, to the great detriment of the larger and more important units, the genera, families and higher groups. While there is a very general agreement among systematists as to what constitutes a species or a subspecies or variety, the concept of a genus is found to vary widely; we have not yet brought ourselves to see the necessity of bestowing that care upon the genera which we use in the study of species and minor divisions. Yet after all the genera and the families are the units of paramount importance, for they are the units with which the majority of workers must eventually deal. Zoology has become such a vast field that he who would occupy himself with species must of necessity restrict himself to a very small section of the animal kingdom.

It has therefore become essential for us to examine the characteristics of natural genera, and to analyze them carefully in order that we may discover certain general truths which will aid us in determining what genera are logical and valid and what are mere artificial aggregations, brought together solely for the sake of convenience.

As commonly accepted, a genus is a group of species which is separated from all other similar groups of species by some character common to all the component units, the latter being differentiated *inter se* by the unequal development of the specific, or, more accurately, intergeneric variables. In case a group of species uniformly differs from another similar group in the majority of the characters available for systematic purposes, that group is properly considered a family or a subfamily.

Immediately upon its appearance, a genus (at this stage merely a vigorous species) spreads in every direction just as far as it is possible to maintain itself, that is, until it encounters on every side insurmountable barriers. But the conditions found throughout this habitable area are not uniform. This causes many local races to develop, each grading insensibly into all those surrounding it. Thus a genus in its infancy is in reality a well-marked species, differentiated into many geographical races.

These races do not long maintain themselves in their original relationships. There is somewhere within the range of this young genus, normally at or near the center, an area of optimum conditions, where life is easy and there is no severe struggle for existence. Here various more or less aberrant types arise and are able to perpetuate themselves, spreading out in every direction as did the original stock, but never so far, as they are not so well prepared to encounter adverse conditions. Thus in the second stage a genus is in reality a well-marked species, differentiated into many geographical races, and in the center of its range being accompanied by several additional closely allied species.

After the formation of these several supernumerary species, each usually with a few races of its own, the genus soon reaches maturity. Each of the numerous component forms increases in numbers so that in its own little sphere the struggle for existence becomes acute, and any variation from an arbitrary type is unable to maintain itself. The forms occupying the limits of the range of the genus as a whole (geographical or bathymetrical) are continually trying to colonize new territory, both from their own initiative and as the result of pressure from behind. This encounter with generically unfavorable conditions induces, in the border forms, a more or less pathological condition, inducing great individual variation; and so we normally find that the species which occupy the outer borders of the area inhabited by the genus as a whole, just as in any species the individuals from the edge of the area inhabited by it, are much more variable than those from any other part.

If we take the species of any genus which has reached the stage of maturity just described and arrange them according to the proportionate value of their specific characters, we find in the center a single species, or a group of closely allied species, whose range is coterminal with that of the genus as a whole. This species is, moreover, typically the most variable of any in the genus, and probably is very close to the original stock.

The period of maturity being passed, senescence begins to assert itself. By long existence under fixed conditions the various component species become, as it were, delicate, and are unable to withstand any changes in their environment. Such changes are, however, of constant occurrence, affecting greater or lesser areas; and therefore discontinuance of distribution creeps in, species being cut off from the main zoogeographic area inhabited by the genus, one by one, by the extirpation of the intermediate forms. It often happens, also, that changing ecological conditions at the center of distribution of the genus, such as the local development or introduction of predaceous forms, or of external or internal parasites, destroys the typical form there, leaving only aberrant types; or they may even obliterate all traces of the genus.

Very old genera are thus characterized by having but few species in widely separated localities, each widely different from the others. These are usually (and rightly) regarded as representing a family composed of a few monotypic, or nearly monotypic, genera.

Very often old genera undergo what has aptly been termed an "explosion" of the intergeneric characters, and are then composed wholly, or almost wholly, of curious and eccentric species; again a genus in its senescence often is marked by a great development of certain characters at the expense of others, which usually leads to prompt extinction. In certain localities large numbers of species are remarkable for their eccentric development, and the exaggeration of certain characters out of all proportion to the others, which, so far as we can see, serves no useful purpose. Such localities from a zoological point of view must be considered as old and to have persisted in their present state beyond the normal life cycle of the genera which have given rise to the erratic species. Just as the life cycle of different animals varies enormously, so does that of species and of genera. Scores of genera belonging to the higher groups of the animal kingdom may arise, grow strong, decline, and finally, with a grand "explosion" of their characters, disappear, before a genus belonging to one of the lower groups, of earlier origin, has reached the summit of its strength.

In discussing genera, as well as species, one must always keep in mind that for all animals there are two, and for aquatic animals three types of distribution, viz., (1) geographical, with purely inorganic physical barriers; (2) ecological, with wholly organic barriers, consisting of presence or absence of food and predaceous or parasitic enemies; and (3) bathymetric, again with purely physical barriers of pressure and temperature, the latter commonly being the more important with lower animals, the former with the higher.

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